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(54) Title: TARNISH-RESISTANT STERLING SILVER ALLOYS

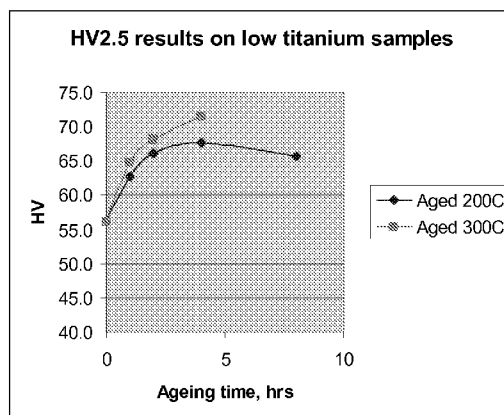


FIG. 1

(57) Abstract: Titanium sterling silver alloy compositions and optionally palladium or niobium, among other metals that exhibit enhanced tarnish resistance while maintaining a unique acceptable hardness. Applications and manufacturing methods thereof are disclosed. The present invention delivers these benefits and improvements by providing a sterling silver alloy containing the following parts by weight: about 92.5 to about 99.5% silver, about 0.5 to about 7.0% titanium, about 0 to about 6.5% palladium, and about 0 to about 7.0% niobium.



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/028676

<p>A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - C22C 1/03 (2012.01) USPC - 420/503 According to International Patent Classification (IPC) or to both national classification and IPC</p>																																															
<p>B. FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols) IPC(8) - C22C 1/03, 5/06; C23C 22/58; C23G 5/04 (2012.01) USPC - 148/678; 420/503, 505; 428/673</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) PatBase, Google Patent, ProQuest, Engineering Village</p>																																															
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>US 7,897,266 B2 (EVERETT, JR et al) 01 March 2011 (01.03.2011) entire document</td> <td>1-4, 6, 7</td> </tr> <tr> <td>---</td> <td></td> <td>-----</td> </tr> <tr> <td>Y</td> <td></td> <td>5, 8-32</td> </tr> <tr> <td>Y</td> <td>US 4,708,847 A (DONOMOTO et al) 24 November 1987 (24.11.1987) entire document</td> <td>14-32</td> </tr> <tr> <td>Y</td> <td>US 2008/0166260 A1 (FAVERJON et al) 10 July 2008 (10.07.2008) entire document</td> <td>5</td> </tr> <tr> <td>Y</td> <td>US 5,037,708 A (DAVITZ) 06 August 1991 (06.08.1991) entire document</td> <td>8-10, 28</td> </tr> <tr> <td>Y</td> <td>EP 1 213 599 A2 (UENO) 12 June 2002 (12.06.2002) entire document</td> <td>10-13</td> </tr> <tr> <td>Y</td> <td>US 6,139,652 A (CARRANO et al) 31 October 2000 (31.10.2000) entire document</td> <td>15, 22</td> </tr> <tr> <td>Y</td> <td>US 4,959,194 A (DUNN et al) 25 September 1990 (25.09.1990) entire document</td> <td>16, 17, 26</td> </tr> <tr> <td>Y</td> <td>US 6,221,173 B1 (SHIBUYA et al) 24 April 2001 (24.04.2001) entire document</td> <td>18-21</td> </tr> <tr> <td>Y</td> <td>US 3,540,883 A (COMEY, JR) 17 November 1970 (17.11.1970) entire document</td> <td>25</td> </tr> <tr> <td>Y</td> <td>US 4,810,308 A (EAGER et al) 07 March 1989 (07.03.1989) entire document</td> <td>30, 31</td> </tr> <tr> <td>Y</td> <td>US 2,793,097 A (MCKENNA) 21 May 1957 (21.05.1957) entire document</td> <td>21</td> </tr> <tr> <td>Y</td> <td>US 3,660,074 A (BUEHL) 02 May 1972 (02.05.1972) entire document</td> <td>29</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 7,897,266 B2 (EVERETT, JR et al) 01 March 2011 (01.03.2011) entire document	1-4, 6, 7	---		-----	Y		5, 8-32	Y	US 4,708,847 A (DONOMOTO et al) 24 November 1987 (24.11.1987) entire document	14-32	Y	US 2008/0166260 A1 (FAVERJON et al) 10 July 2008 (10.07.2008) entire document	5	Y	US 5,037,708 A (DAVITZ) 06 August 1991 (06.08.1991) entire document	8-10, 28	Y	EP 1 213 599 A2 (UENO) 12 June 2002 (12.06.2002) entire document	10-13	Y	US 6,139,652 A (CARRANO et al) 31 October 2000 (31.10.2000) entire document	15, 22	Y	US 4,959,194 A (DUNN et al) 25 September 1990 (25.09.1990) entire document	16, 17, 26	Y	US 6,221,173 B1 (SHIBUYA et al) 24 April 2001 (24.04.2001) entire document	18-21	Y	US 3,540,883 A (COMEY, JR) 17 November 1970 (17.11.1970) entire document	25	Y	US 4,810,308 A (EAGER et al) 07 March 1989 (07.03.1989) entire document	30, 31	Y	US 2,793,097 A (MCKENNA) 21 May 1957 (21.05.1957) entire document	21	Y	US 3,660,074 A (BUEHL) 02 May 1972 (02.05.1972) entire document	29
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<p>Date of the actual completion of the international search 31 May 2012</p>		<p>Date of mailing of the international search report 20 JUN 2012</p>																																													
<p>Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201</p>		<p>Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774</p>																																													

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2012/028676

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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Y	US 2007/0113707 A1 (CASCONE) 24 May 2007 (24.05.2007) entire document	29
A	CHEN et al. Evaporation of Silver during Cofiring with Barium Titanate. Journal of the American Ceramic Society. Vol. 83 No. 7. Pp. 1693-98 (2000). entire document	1-32
A	US 4,799,532 A (MIZUHARA) 24 January 1989 (24.01.1989) entire document	1-32
A	US 2004/0161630 A1 (SPECHT et al) 19 August 2004 (19.08.2004) entire document	1-32
A	US 2008/0118392 A1 (SALVO) 22 May 2008 (22.05.2008) entire document	1-32
A	WO 2006/106282 A1 (JONES et al) 12 October 2006 (12.10.2006) entire document	1-32

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Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

- 1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

- 2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

- 3. Claims Nos.: 33-36
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

- 1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
- 2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
- 3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

- 4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

- Remark on Protest**
- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
 - The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
 - No protest accompanied the payment of additional search fees.